TITLE OF THE PRESENT INVENTION

THE USE OF JOB INTERRUPT FUNCTIONALITY FOR THE PRODUCTION OF INTERRUPTING AND SAMPLE JOB OUTPUT IN DIGITAL PRINTING SYSTEMS

FIELD OF THE PRESENT INVENTION

The invention relates to the art of digital printing. It finds specific application as part of a digital production printing system.

BACKGROUND OF THE PRESENT INVENTION

During the printing of long jobs, especially those with color critical output, it is often desirable to view sample copies. Viewing samples allows the press operator to ensure that the appropriate content is being printed and that the appearance of the output matches the customers expectations. When offset presses are used, examining a sample is fairly straightforward. Copies of just one page are being produced at any one time and there are access points in the printing press that allow sheets to be viewed, and in some cases retrieved, during the printing process.

An offset printing press might, for example, have five print units. Each print unit applies one color in a multi-color printing operation. The press is usually open and the quality of the print job can be monitored by looking at the output of each print unit as it is conveyed from one print unit to the next. Adjustments to the print units can be made as the job runs.

In digital production printing, multi-page documents are being produced and delivered via closed paper paths to finishing devices that do not allow convenient access to printed output until the printing process is complete. As a result, it is extremely difficult to monitor product

quality during a digital production printing job. If a problem develops in the middle of a job it is not noticed until after the job is complete. In large jobs, this can be very costly, both in wasted time and material.

Some attempts have been made to give digital printing systems more of the on-the-fly adjustability that is common in offset presses. U.S. Patent 5,606, 395 to Yang et al. and assigned to Xerox Corporation, is for a method and apparatus that allow an operator to monitor a digital printing system's output tray and enter fine-tuning commands through an electronic control. The operator can determine the effectiveness of his commands by watching how they affect the sheets that arrive at the output tray.

This technique is most effective when copies of only one page are being printed. When collated copies of multi-page documents are being produced, and the sheet or sheets of interest are covered by the top sheet, this technique loses its usefulness. In order to check the adjustments, the operator has to remove a completed compilation from the output tray, unwrap it (if it is shrink wrapped), and sort through the sheets to find the sheet or sheets of interest. If further corrections are needed then all the copies created in the meantime, have to be discarded or reworked. In either case, time and material are wasted.

An improvement is needed in digital production printing systems that allows print quality to be monitored in real-time.

The present invention is such an improvement. It allows a user to specify which parts of a job are critical, or representative of the job. The user can also indicate how often sample copies of each of those parts should be produced. The samples can be assessed, either by the user or a device. If a problem develops in the middle of a run, such as, poor registration, streaking or color drift, the

operator will see it reflected in the samples and can pause the job and take corrective action and then resume the job. Alternatively a sensor can examine the samples and provide information to the machine to allow it to make automatic corrections to the process.

SUMMARY OF THE PRESENT INVENTION

One aspect of the present invention is a method for producing interrupting jobs during the production of a main job in an document processing apparatus. Such an apparatus usually comprises a plurality of machine modules that together process and/or produce printed media. The method comprises the steps of specifying a main job, where the main job comprises component parts and has at least one measure of progress; starting production of the main job; monitoring at least one measure of progress of the main job; specifying an interrupting job; interrupting the main job at a point when productivity is maintained and media is not wasted; producing the interrupting job, and; resuming the main job.

Another aspect of the present invention is a document processing apparatus comprising a plurality of machine modules in communication with each other for processing and/or producing printed media; at least one computing platform in communication with the plurality of machine modules for controlling and orchestrating the activities of the modules; a plurality of document collection points attached to at least one of the modules, and at least one of the plurality of document collection points designated, at least temporarily, as an interrupting job delivery point.

Another aspect of the invention allows for samples to be produced based on the number of copies produced in the main job.

Another aspect of the invention allows for samples to be produced based on main job run time.

Another aspect of the invention provides for the samples to be delivered at a convenient location apart from the main job delivery location.

Yet another aspect of the invention provides for high priority jobs to be requested instead of sample jobs.

One advantage of the present invention over the prior art is that it allows job quality to be monitored at a minimal cost.

Another advantage of the present invention is that it allows corrective action to be taken before large amounts of time and material are wasted due to poor print quality.

Yet another advantage of the present invention is that it allows a high priority job to interrupt a long print job with only minimal disruption to that job.

Still other advantages of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

Figure 1 shows a first digital production printing system comprising a first arrangement of modules in accord with the present invention;

Figure 2 shows a second digital production printing system comprising a second arrangement of modules in accord with the present invention;

Figure 3 is a flow diagram showing a first embodiment of the present invention;

Figure 4 is a flow diagram showing a second embodiment of the present invention;

Figure 5 is a flow diagram showing another aspect of the present invention;

DETAILED DESCRIPTION OF THE PRESENT INVENTION

The present invention is for a digital printing system with an improved method for monitoring document quality. Samples of critical or representative parts of a main job are delivered, during main job production, to a location separate from where the main job documents are delivered. The operator can retrieve and examine these samples during job production and can immediately take corrective action if needed. Alternatively sensors can assess document quality and provide information for automatic system tuning.

Referring to Figure 1, first digital printing system **10** comprises a number of removable and/or replaceable modules. Digital front end **12** is an operator interface and tie point for other devices such as document scanners and computer networks. The operator uses the digital front end **12** to enter information about print jobs. The information includes the source of images to be printed, the number of document copies required, the medium on which the document is to be printed, the type of binding to be used, etc. The digital front end then communicates this information, in the form of a job description, to a mark facility controller **14** via a communications path **15**. The mark facility controller **14** controls the modules that comprise the digital printing system. It directs feeding devices **16** to deliver the appropriate size and type of paper or other media to a print engine **18** at the appropriate time. The

mark facility controller **14** also coordinates the delivery of images to the print engine and directs it to print those images on the media delivered to it by feeding devices **16**. It then orchestrates the delivery of printed pages to the appropriate finishing device. For example, a first finishing device **20** might be used to collate and bind a main job and a second finishing device **22** might be used to deliver sample pages. Alternatively, sample sheets might be delivered to a sample/purge tray **24**.

Referring to Figure 2, second digital printing system **70** includes a digital front end **72**, a feeding device **74**, a print engine **76** and a collator **78**. The collator **78** assembles each document copy in one of a set of document trays **80**. Configuration information designates one of the document trays **80** to be a sample or interrupting job output tray **82**.

Digital printing systems **10** and **70** are just two examples of module configurations that can be used to practice the present invention and are not meant to limit the invention. Other configurations are possible. In some cases there may only be one computing platform visible. The computing platform might be a digital front end or it might carry out both the functions of a digital front end and a mark facility controller. In some cases the mark facility controller may be hidden from view. The mark facility controller might be installed in one of the modules, such as a print engine, that comprise the system. The digital front end function might be handled over a network. Therefore it is possible to build a system to practice the present invention that has no visible computing platform. Furthermore, systems can comprise multiple print engines and/or multiple feeding devices and/or multiple finishing devices. It is even possible to practice the present invention with a system that does not

include a print engine. One example of such a system is a signature booklet maker, which is familiar to those of ordinary skill in the art.

A first embodiment of a method in accordance with the present invention is outlined in Figure 3. For purposes of illustration, this embodiment has been broken down into two processes, a first job specification process **200** and a first job fulfillment process **202**. First job specification process **200** might be run on a digital front end **12** while first job fulfillment process **202** might be run on a mark facility controller **14**. However, both processes might also be run on a single computing platform or be further broken down and distributed as tasks for other devices or people to perform.

First job specification process **200** begins with a collection of job specifications **204**. These specifications include the source for the images to be printed, the number of pages to be printed, which if any, are to be printed in color, which if any, are to be printed in high resolution, the size and kind of media on which they are to be printed etc. This information can be provided by the operator via means such as keyboard and/or mouse entry, or it can be provided electronically as a computer file or via a computer network connection.

The next step is a collection of a critical or representative parts list **206**. This information is either provided electronically or it is provided by the operator after reviewing the job. It is a list of parts of sheets, sheets or compilations of sheets that require special attention, such as color pages or shrink wrapped compilations of sheets.

In addition, a collection of sample intervals for each critical or representative part is also made **208**. The sample intervals indicate how often during the production

of the main job, samples of each critical or representative part should be produced. For example a sample interval specification might be set so that a sample of a particular sheet is produced at a sample location, such as sample/purge tray **24** each time 25 copies of that sheet are produced at the main job location, such as first finishing device **20**. Another part of the main job, less prone to error, might be sampled each time 100 copies are produced at the main job location.

Most of this information is compiled to create a main job description **210**. The main job description includes the job specifications and the critical or representative parts list. The main job description is submitted **212** to the first job fulfillment process **202**. In this embodiment the sample intervals are not submitted to the job fulfillment process but are kept for later use by the first job specification process **200**.

At this point, the first job specification process **200** waits **214** to be notified that one of the listed critical or representative parts of the job is being processed. A counter is associated with each part in the list. When the first job specification process **200** receives notification that one of the listed parts is being processed it increments **218** the appropriate counter. The value in that counter is tested **220** to see if it corresponds to the sample interval specified for the incident part. If it does, a sampled job description is generated **222**, and then submitted **224** to the job fulfillment process **202**, the counter is reset and the process waits for the next notification.

A sample job description is similar to the main job description discussed above. It is however, different in that it is identified as a sample job request and that it is for a short run of a subset of the main job.

It should be noted that while this embodiment uses a count of produced documents to determine when it is time to produce samples, other measures of job progress are possible. One alternative measure of job progress is main job run time. Samples could be produced based on a time interval, every five minutes for example. It is intended that methods that use other measures of job progress are within the scope of the invention.

When the first job fulfillment process **202** receives a job description it analyzes **226** it. It determines whether or not **228** the job is a sampled job.

If it is a sample job, the first job fulfillment process **202** looks for an efficient interruption point in the main job **230**, inserts **232** the sample job there, processes it, and then resumes main job processing.

If the job description does not call for a sample job, it is placed **234** on the main job queue. When it reaches the front of the queue it is processed **236**. As it is processed, each part is examined **238** to determine whether it is on the critical or representative parts list. If it is, then notification of that fact is sent to first job specification process **200**.

If both the first job specification process **200** and the first job fulfillment process **202** are carried out by one computing platform then communication paths **242** and **244** represent any technique used to transfer information between program functions, modules, objects or routines. If the processes are carried out on two or more computing platforms then communications paths **242** and **244** represent buses, networks, or other computer communications means.

Of course, this method can be repeated in whole or in part as many times as is required to successfully produce the main job or a series of main jobs.

A second embodiment of a method in accordance with the

present invention is outlined in Figure 4. As will be seen, it is similar to that shown in Figure 3. Similar parts carry the reference designators introduced in Figure 3.

Second job specification process **250** includes a step for collecting job specifications **204**, a step for collecting **206** a critical or representative parts list and a step for collecting **208** a desired sample interval for each part just as first job specification process **200** does. It has a different job description creation step **254** however. In this embodiment a job description includes the desired critical or representative part sample interval information.

The job description is submitted **212** to a second job fulfillment process **252**. In this embodiment, the second job specification process **250** does not keep track of the number of times each critical or representative part is processed. Instead that task is carried out by the second job fulfillment process **252**.

When notification is received by the job specification process, it indicates that the incident part has been processed a number of times corresponding to the sample interval specification and a sample job description is generated **222** and submitted **224** to the second job fulfillment process **252**.

It should be noted that while this embodiment uses a count of produced documents to determine when it is time to produce samples, other measures of job progress are possible and it is intended that methods that use such other methods are within the scope of the invention. For example main job run time could be measured and samples could be produced based on a time interval, every ten minutes for example.

When the second job fulfillment process **252** receives

a job description it analyzes it **226**.

If it is a sample job description the second job fulfillment process **252** looks **230** for an efficient interruption point in the main job, inserts the sample job there, processes it, and resumes processing **232** the main job.

If it is not a sample job, it is placed **234** on the main job queue. When it reaches the front of the queue, it is processed **236**. As it is processed, each part is examined to determine **256** whether it is on the critical or representative parts list. If it is, then a counter associated with that part is incremented **258**. The value of that counter is then checked **238** to see if it corresponds to the sample interval specification for the incident part. If it does, notification of that fact is sent to second job specification process **250**, the counter is reset and processing continues.

Of course, this method can be repeated in whole or in part as many times as is required to successfully produce the main job or a series of main jobs.

Again, if both the second job specification process **250** and the second job fulfillment process **252** are carried out by one computing platform then communication paths **242** and **244** represent any of the techniques used to transfer information between program functions, modules, objects or routines. If the processes are carried out on two or more computing platforms then communications paths **242** and **244** represent buses, networks, or other computer communications means.

The mechanisms created in order to accommodate sample job production also allow for other features to be incorporated into a digital printing system. Accordingly Figure 5 depicts how those sample job producing mechanisms are used to interrupt a main job in order to produce a high

priority job. For clarity, this method is shown separate from the first and second embodiments. However, this method can be incorporated in those embodiments, or others. Again, where steps are similar to steps previously introduced, they carry the reference designators of those previously introduced steps.

A third job specification process **300** and a third job fulfillment process **302** work together to produce a high priority job. In the third job specification process **300**, a second job specifications step **304** is followed by a priority determination step **306**. Second job specification step **304** includes gathering job priority information. Priority determining step **306** uses that information to determine which further processing path is appropriate.

If the job is of standard priority then a standard job description is created **308** and submitted to the third job fulfillment process **302**. If the job has a high priority then a job description is created **312** including a high priority designation. The job specification is then submitted **302** to the third job fulfillment process **302**.

When a job description is submitted to the job fulfillment process it is analyzed **226** and its priority is determined **314**.

If it is of high priority, the third job fulfillment process looks **230** for an efficient interruption point in the main job and inserts **316** the high priority job there, processes it, and resumes main job processing.

If it is of normal priority it is placed in the main job queue **234**. When it reaches the front of the queue, it is processed **236**.

Of course, this method can be repeated in whole or in part as many times as is required to successfully produce the main job and high priority jobs or a series of main jobs and high priority jobs.

The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come with the scope of the appended claims or equivalents thereof.

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CLAIMS

What is claimed is:

1. In a document processing apparatus comprising a plurality of machine modules for processing and/or producing printed media, a method for producing interrupting jobs during the processing of a main job, the method comprising the steps of:

specifying the main job, the main job having at least one measure of progress;

starting production of the main job;

requesting an interrupting job;

interrupting the main job at a point when productivity is maintained and media is not wasted;

producing the interrupting job, and;

resuming the main job.

2. The method of claim 1 wherein the step of specifying an interrupting job further comprises specifying a sample job comprising a component part of the main job.

3. The method of claim 2 wherein the step of specifying a sample job further comprises:

specifying representative parts of the main job to be sampled;

specifying a sample interval for each specified representative part.

4. The method of claim 3 further comprising, after the step of starting production and before the step of requesting, the steps of:

measuring the interval for each specified representative part;

determining if the specified sample interval has

elapsed for any of the specified representative parts, and if it has;

generating a sample job specification corresponding to the representative part for which the interval has elapsed.

5. The method of claim 4 wherein the interval is measured in the number of copies produced in the main job.

6. The method of claim 4 wherein the interval is measured main job run time.

7. The method of claim 1 further comprising before the step of requesting an interrupting job:

specifying an interrupting job of high priority.

8. The method of claim 7 further comprising, before the step of interrupting, the step of:

assessing the priority level of the interrupting job and if the priority level of the interrupting job is higher than the priority level of the main job, proceeding to the step of interrupting.

9. The method of claim 1 wherein the step of producing the interrupting job further comprises delivering the interrupting job at a convenient location apart from the main job delivery location.

10. In a document processing apparatus including a plurality of machine modules that process and/or produce printed media, a method for producing sample copies of specific parts of a document, the method comprising the steps of:

specifying a job;

specifying which parts of the job are representative;

specifying a sample interval for each of the representative parts of the job;

producing the job;

measuring intervals for each of the specified representative parts and when a particular interval is reached;

generating an interrupting job description calling for the generation of a sample of the representative part of the job corresponding to the particular interval that was reached;

presenting the interrupting job description for processing;

analyzing the interrupting job description;

determining an efficient point in the job to produce the samples;

interrupting the main job at the efficient point;

processing the interrupting job description to produce the sample, and;

resuming the main job.

11. A document processing apparatus comprising:

a plurality of machine modules in communication with each other for processing and/or producing printed media;

at least one computing platform in communication with the plurality of machine modules for controlling and orchestrating the activities of the modules;

a plurality of document collection points attached to at least one of the modules; and,

at least one of the plurality of document collection points designated, at least temporarily, as an interrupting job delivery point.

12. The document processing apparatus of claim 11 wherein the at least one computing platform further

comprises a digital front end and a mark facility controller in communication with each other.

13. The document processing apparatus of claim 11 wherein the plurality of machine modules comprises at least one feeder device and at least one finishing device.

14. The document processing apparatus of claim 11 wherein the plurality of machine modules comprises at least one print engine.

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THE USE OF JOB INTERRUPT FUNCTIONALITY FOR THE PRODUCTION OF SAMPLE JOB OUTPUT IN DIGITAL PRINTING SYSTEMS

ABSTRACT OF THE DISCLOSURE

Main job production progress is monitored **220, 238** so that sample copies of parts of the main job that are designated critical or representative of the job as a whole can be produced on a regular interrupting basis. The samples are used to monitor production quality.

Digital printing system modules are arranged and configured to provide a sample job destination **22,24,48,58,82** separate from the main job destination.

66h2TT" T2E6mh6D

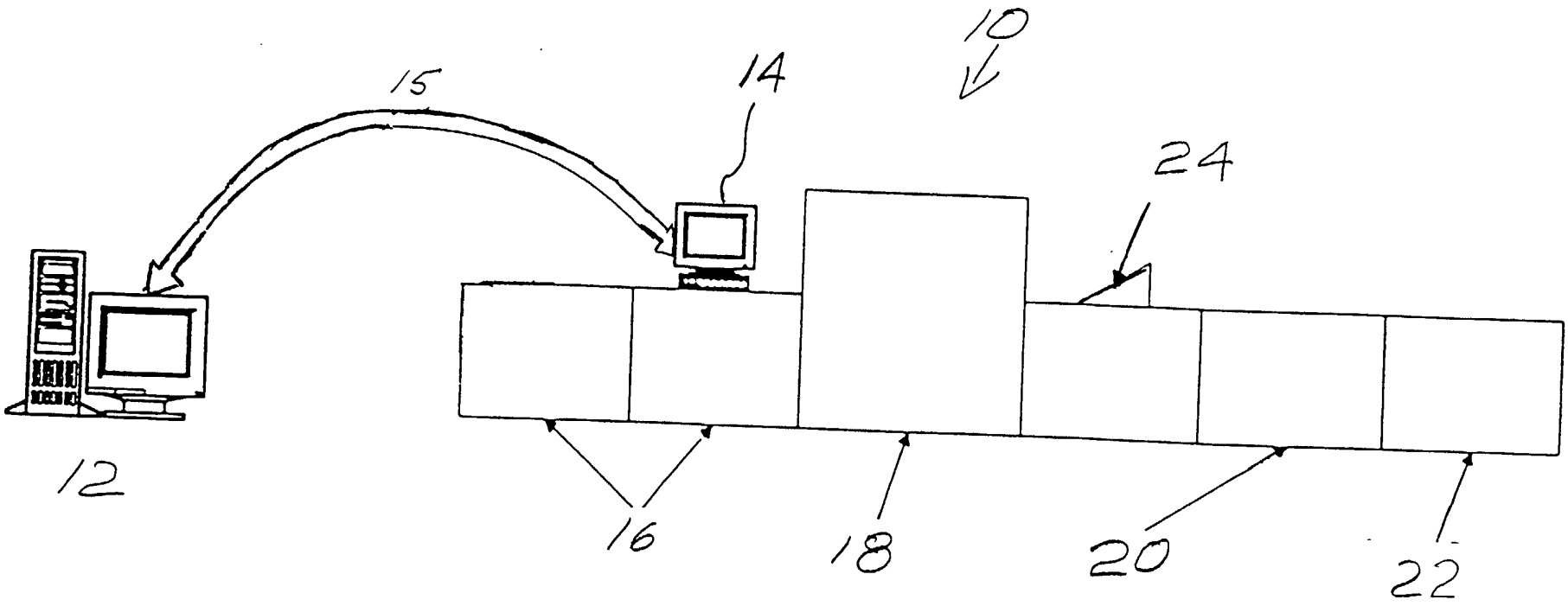

Fig. 1

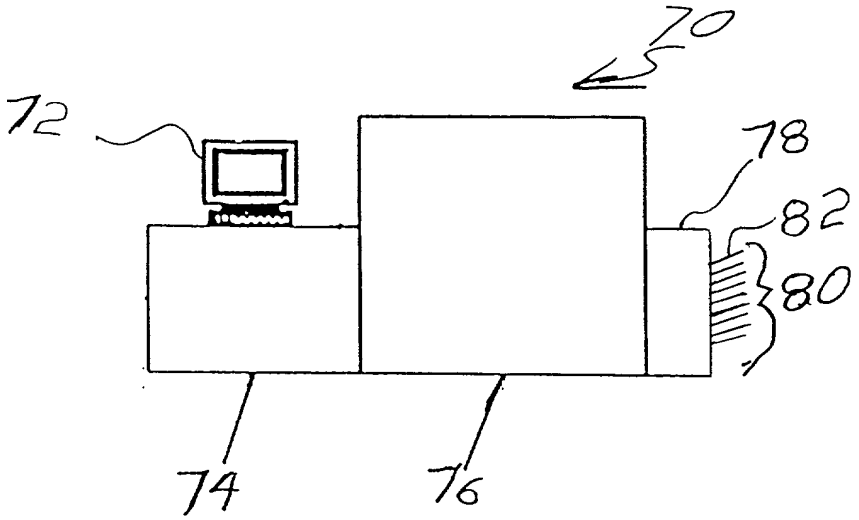

Fig 2

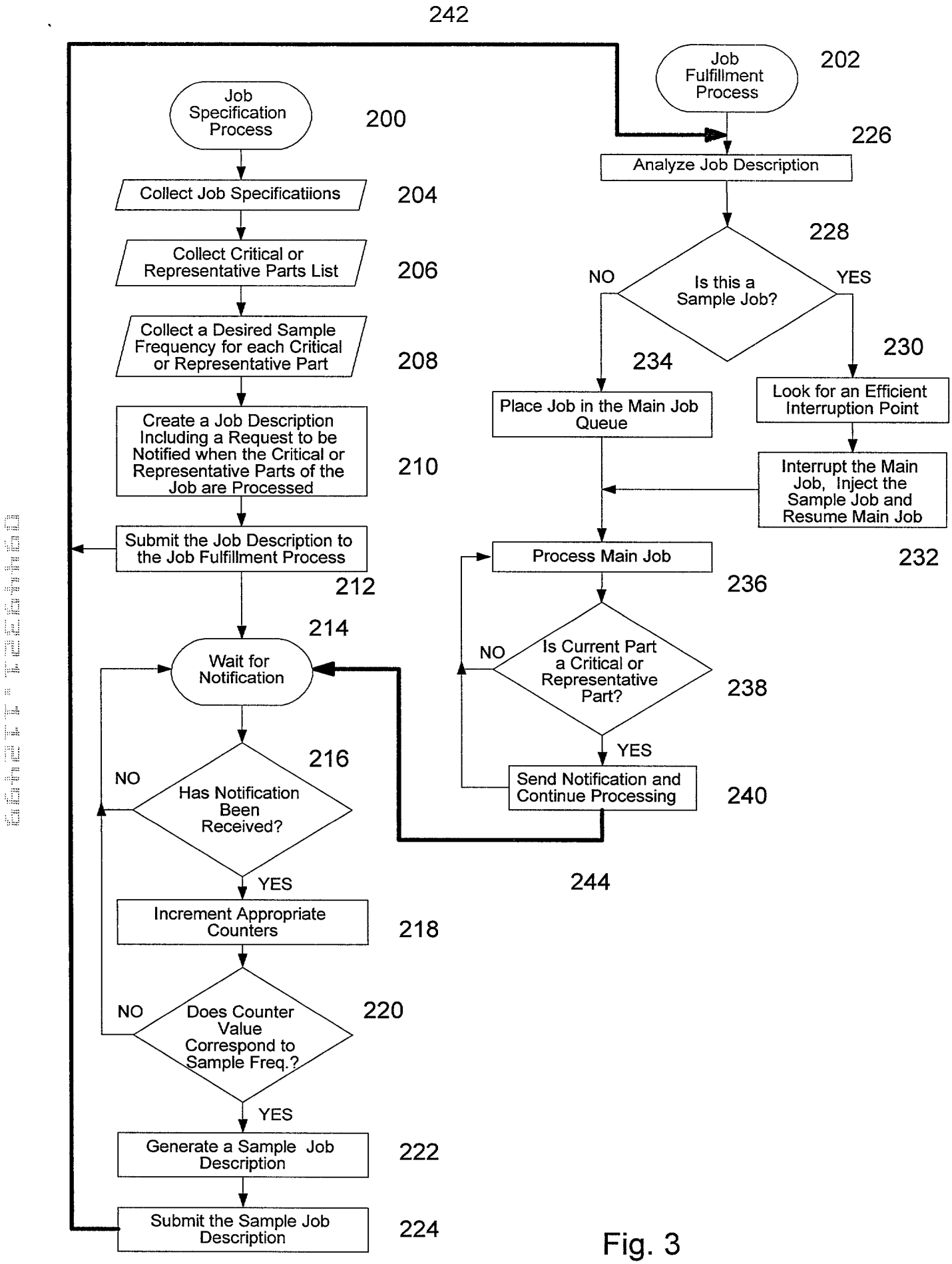
242
Job Specification Process
200
Collect Job Specificatiions
204
Collect Critical or Representative Parts List
206
Collect a Desired Sample Frequency for each Critical or Representative Part
208
Create a Job Description Including a Request to be Notified when the Critical or Representative Parts of the Job are Processed
210
Submit the Job Description to the Job Fulfillment Process
212
214
Wait for Notification
216
NO
Has Notification Been Received?
YES
Increment Appropriate Counters
218
NO
Does Counter Value Correspond to Sample Freq.?
220
YES
Generate a Sample Job Description
222
Submit the Sample Job Description
224
Job Fulfillment Process
202
226
Analyze Job Description
228
NO
Is this a Sample Job?
YES
230
234
Place Job in the Main Job Queue
Look for an Efficient Interruption Point
Interrupt the Main Job, Inject the Sample Job and Resume Main Job
232
Process Main Job
236
NO
Is Current Part a Critical or Representative Part?
238
YES
Send Notification and Continue Processing
240
244

Fig. 3

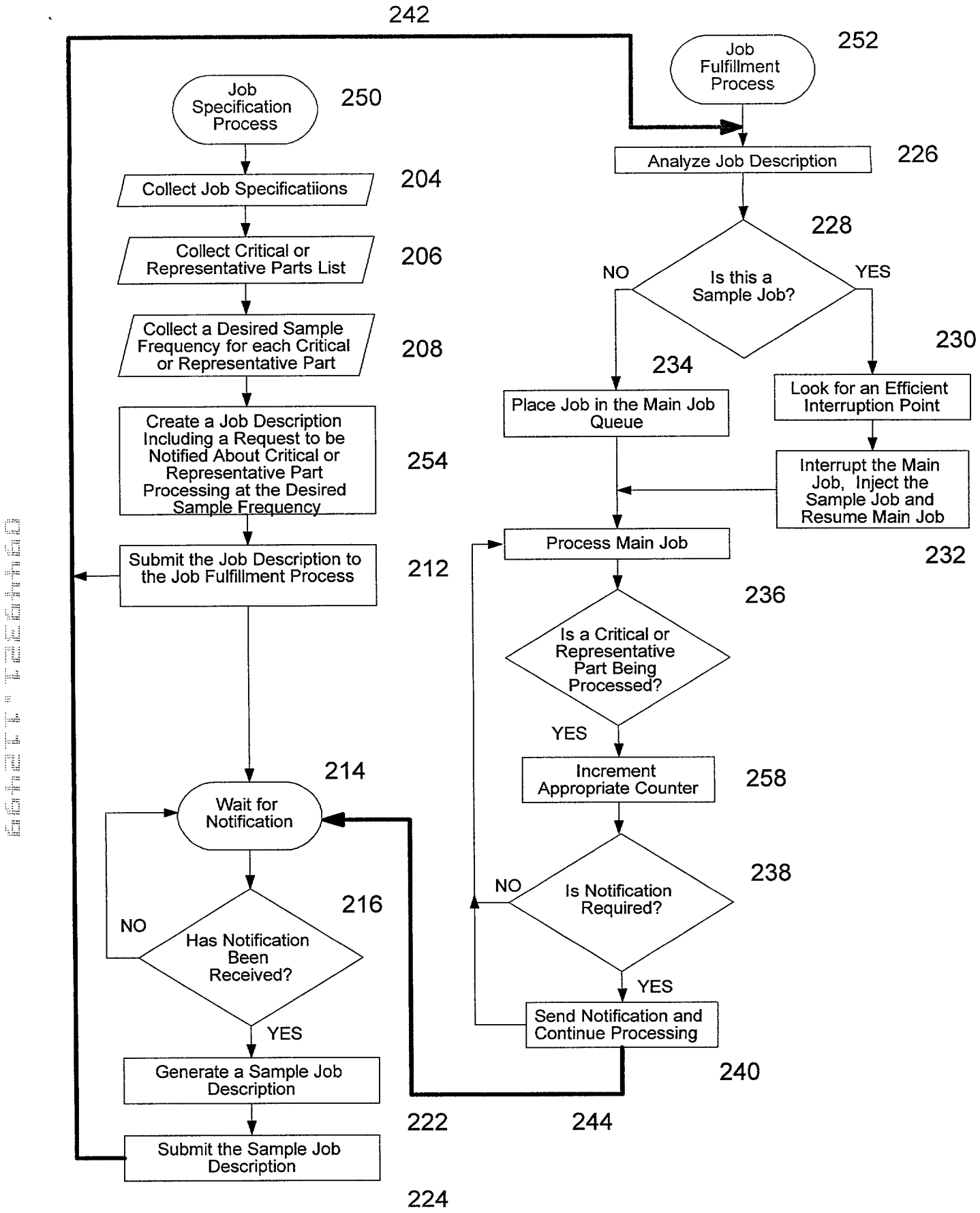
242
Job Specification Process
250
Collect Job Specificatiions
204
Collect Critical or Representative Parts List
206
Collect a Desired Sample Frequency for each Critical or Representative Part
208
Create a Job Description Including a Request to be Notified About Critical or Representative Part Processing at the Desired Sample Frequency
254
Submit the Job Description to the Job Fulfillment Process
212
214
Wait for Notification
216
NO
Has Notification Been Received?
YES
Generate a Sample Job Description
Submit the Sample Job Description
224
222
Job Fulfillment Process
252
Analyze Job Description
226
228
NO
Is this a Sample Job?
YES
230
234
Place Job in the Main Job Queue
Look for an Efficient Interruption Point
Interrupt the Main Job, Inject the Sample Job and Resume Main Job
232
Process Main Job
236
Is a Critical or Representative Part Being Processed?
YES
Increment Appropriate Counter
258
238
NO
Is Notification Required?
YES
Send Notification and Continue Processing
240
244

Fig. 4

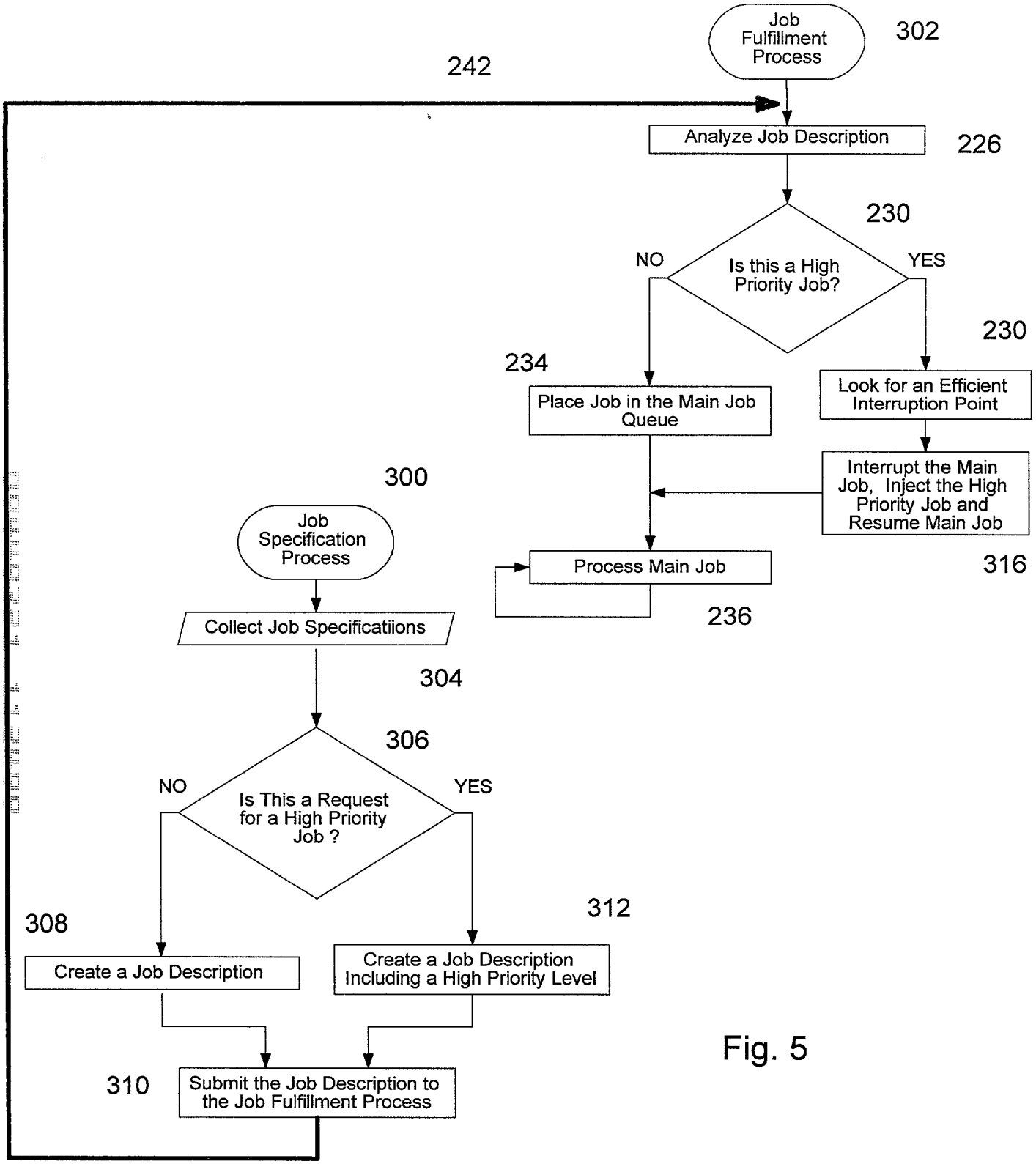
Job Fulfillment Process
302
242
Analyze Job Description
226
230
NO
Is this a High Priority Job?
YES
230
234
Place Job in the Main Job Queue
Look for an Efficient Interruption Point
Interrupt the Main Job, Inject the High Priority Job and Resume Main Job
316
300
Job Specification Process
Process Main Job
236
Collect Job Specificatiions
304
306
NO
Is This a Request for a High Priority Job ?
YES
308
312
Create a Job Description
Create a Job Description Including a High Priority Level
310
Submit the Job Description to the Job Fulfillment Process

Fig. 5

Attorney's Docket No. XER 2 0308
D/98721

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

THE USE OF JOB INTERRUPT FUNCTIONALITY FOR THE PRODUCTION OF INTERRUPTING AND SAMPLE JOB OUTPUT IN DIGITAL PRINTING SYSTEMS

the specification of which

_x_ is attached hereto

__ OR was filed on
Application Serial No.
and was amended on (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 or 365(b) of any foreign or U.S. Provisional application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign or Provisional application(s) for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application

_____	_____	_____
(Number)	(Country)	(Day/Month/Year Filed)

I hereby claim the benefit under Title 35, United States, Section 120 of any United States application(s) or any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information which is material to patentability as defined in Title 37, of Federal Regulations Code, Section 1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
_____	_____	_____
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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